

INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

This material contains information affecting the National Defense of the United States within the meaning of the Espionage Laws, Title 18, U.S.C. Secs. 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law.

S-E-C-R-E-T

25X1

COUNTRY USSR

REPORT

SUBJECT Spectroscopic Work in the USSR:

DATE DISTR. 3 November 1958

NO. PAGES 3

REFERENCES

25X1

DATE OF
INFO.
PLACE &
DATE ACQ.

25X1

SOURCE EVALUATIONS ARE DEFINITIVE. APPRAISAL OF CONTENT IS TENTATIVE.

1. There are three main centers of spectroscopic work in the USSR. In order of their importance they are:
 - a. Leningrad. The State Optical Institute is the center for production of spectroscopic apparatus. Two prominent spectroscopists working in Leningrad are Professor S. E. Frish and Professor A. N. Zaydel.
 - b. Moscow, because of the school of spectroscopists headed by Sergey Leonidovich Mandel'shtam. A second very important figure in the Moscow school is A. K. Rusanov of the Institute of Applied Mineralogy.
 - c. Alma Ata, the Physical-Technical Academy of the Kazakh SSR.² Its most prominent spectroscopists are S. K. Kalinin, A. A. Yavvel³, A. L. Alekseyeva, and L. E. Naymark. The last has published a spectral atlas which is considered a standard work in the USSR.³
2. Spectroscopic activities in the USSR include the following:
 - a. Spectral analysis of gases, under Frish at Leningrad.
 - b. Work with rare earths, done by Zaydel at Leningrad. He was under contract as long ago as 1950 to the Soviet Ministry of Internal Affairs for atomic energy research and was especially successful in applying spectroscopic analytical techniques for the Soviet atomic energy program. He is personally responsible for developing a method for removal of impurities through vaporization of the impure substances and depositing them on a carrier, which is later used as an electrode. The method can be applied only to viscous elements, since lighter elements boil away.

32

| TO | RETAIN | DESTROY |
|---------------|--------|---------|
| TO | | |
| LB | | |
| | | RB |
| | | RL |

S-E-C-R-E-T

25X1

| STATE | X | ARMY | X | NAVY | X | AIR | X | FBI | | | | | | | |
|-------|---|------|---|------|---|-----|---|-----|--|--|--|--|--|--|--|
| | | | | | | | | | | | | | | | |

(Note: Washington distribution indicated by "X"; Field distribution by "#")

INFORMATION REPORT INFORMATION REPORT

S-E-C-R-E-T

25X1

- 2 -

- c. Advanced work is being done by Mandel'shtam in short time radio impulses, through the use of which he avoids opposing influences of the individual complements. This work is recognized in the West as of considerable importance and is being followed by experiments of Western scientists

25X1

- d. Spectral analysis as applied to minerals and ores; Rusanov is particularly active in this field. The area is of special importance to the USSR because of its vast mineral resources and is vital for prospecting in Asia. Spectral analysis is also widely used in industry; spectral analytical results for industry are published in Zavodskaya Laboratoriya, a regular publication concerned with such problems.

3. The Soviets are currently producing the following spectroscopic equipment:

OA 2109, OA 2209, OA-2309, types of optical acoustic gas analyzers, about equal in quality to West German or American equivalents, useful only for industrial application.

The phase fluorometer, for luminescence.

The MN 5106, magnetic gas analyzer.

The FK 4501, photo-colorimeter gas analyzer, especially adapted for automation and process control problems.

The DPG-5-52, oxygen analyzer for depolarization.

The IKSL and IKS 14, infrared spectrographs.

4. Soviet publications since 1953 on spectroscopy have emphasized the following subjects:

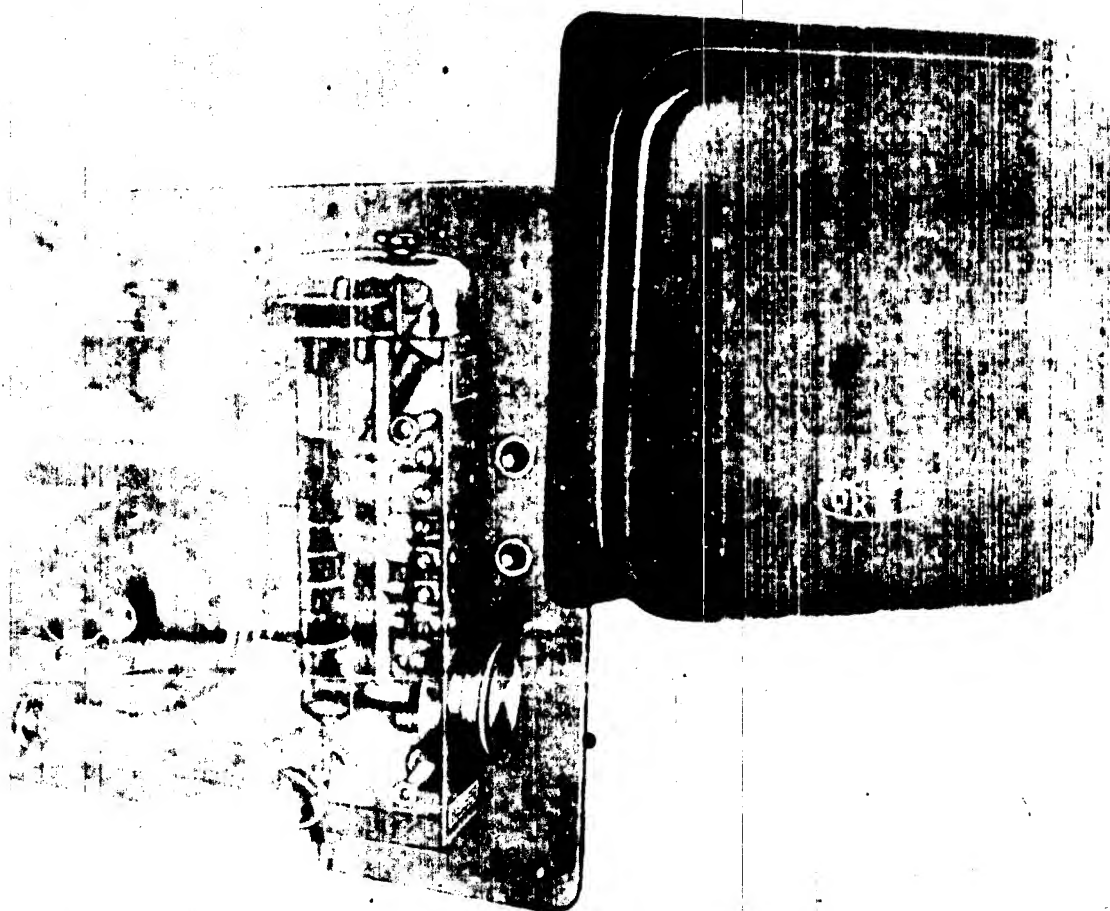
- a. The fact that application of spectral analysis to suitable laboratory problems produces either an appreciable increase in the volume of work a laboratory can handle or permits the same amount of work to be performed by fewer persons. In either event, a substantial saving in trained personnel results.
- b. Recent developments in atomic energy physics and chemistry have made incomplete or useless the application of wet chemical methods. Examples are hafnium, certain rare earth elements, and elements heavier than uranium, all of which have micro-elements accessible only through spectral analysis.
- c. Spectral analysis methods are very useful for problems of automation. Soviet efforts in spectral analysis suffer from the same difficulties as those of the Western world: an intense concentration on the application of spectral analytic methods and insufficient attention to basic research in the field.

S-E-C-R-E-T

25X1

25X1

Page Denied



ANALYSEUR D'OXYGENE
AUX DEPOLARISATION

ДПГ-5-52

The type III-5-52 gas analyser is a stationary electrochemical automatic instrument for continuous determination of the oxygen contents in inflammable or inert gases, also in technological mixtures of organic gases, by measuring the depolarization current.

The presence of electrochemically active gases (chlorine, nitrogen oxides, hydrogen sulphide, etc.) interferes with the determination of the oxygen contents.

The gas to be analysed passed in the absorber of the sensing element is in contact with a solution of sodium sulphate circulating between the absorber and the electrochemical cell. In the solution is thus established an oxygen concentration in equilibrium with the oxygen contents in the gas to be analysed. The electrochemical cell of the instrument has two gold electrodes polarized by a voltage applied. Admitted to the cathode of the cell, the oxygen dissolved in the electrolyte partially depolarizes the electrode, and, as a result, an electrical current flows in the circuit of the sensing element, this current being proportional to the oxygen content in the gas to be analysed.

The complete set of the gas analyser comprises a sensing element, supply unit, secondary instrument, this latter being a 17 mV, type III electronic potentiometer.

ESSENTIAL SPECIFICATIONS

| | |
|-----------------------------------|---|
| Scale of the gas analyser | 0 to 1% oxygen |
| Accuracy, to within | $\pm 10\%$ of the scale range |
| Time constant of the instrument | 3 min. approx. |
| Lag in reacting | 10 sec. |
| Input gas pressure | 800 to 1000 mm H ₂ O |
| Temperature of mix to be analysed | +10 to +35°C |
| Flow of gas to be analysed | 14 litres per hour |
| Ambient air temperature | +10 to 35°C |
| Relative air humidity | up to 80% |
| Supply | 220 V $\pm 10\%$, 50 c/s $\pm 1\%$ mains |
| Energy consumption | 110 W |

Overall Dimensions and Weight of Complete Set

| Instrument Unit | Length mm | Width mm | Height mm | Weight kg |
|--------------------------------|--------------|-------------|--------------|--------------|
| Sensing element | 330 | 160 | 340 | 15 |
| Supply unit. | 275 | 180 | 220 | 8 |
| Secondary instrument, type III | 420 | 292 | 506 | 27 |

**DEPOLARIZATION
GAS ANALYSER
FOR OXYGEN**

**DEPOLARISATION-GASANALYSATOR
ZUM MESSEN
DES SAUERSTOFFGEHALTS**

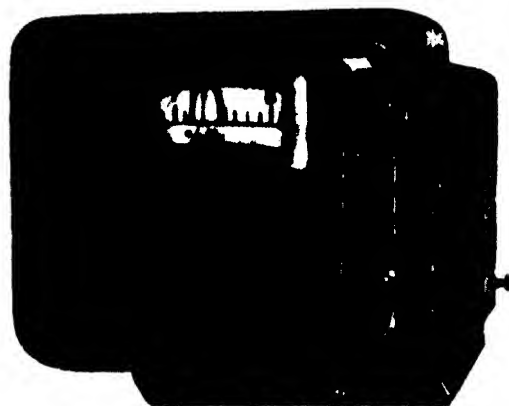
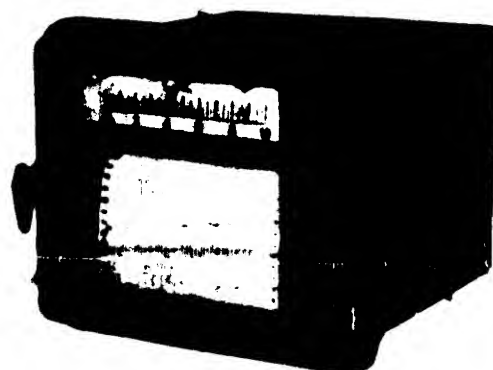
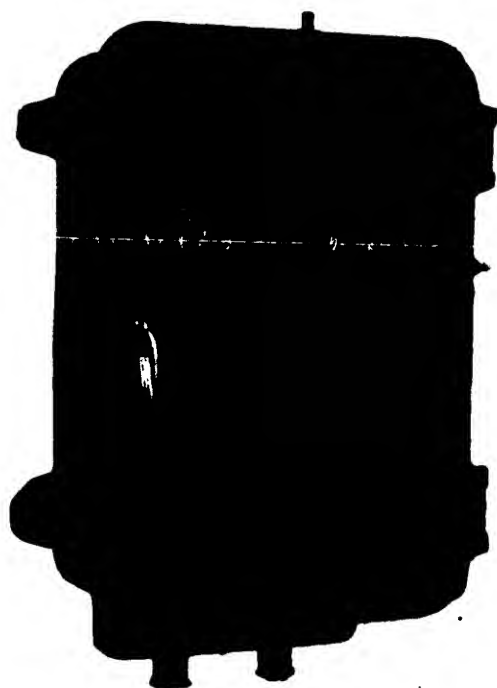
ДП-5-52

USSR SECTION · BRUSSELS UNIVERSAL AND INTERNATIONAL EXHIBITION 1958

ABTEILUNG DER UDSSR AUF DER AUSSTELLUNG IN BRUSSEL 1958

**ANALYSEUR MAGNETIQUE DE GAZ POUR
LA MESURE AUTOMATIQUE
DE LA TENEUR EN OXYGENE**

MII 5106



**ION DE L'URSS A L'EXPOSITION UNIVERSELLE ET INTERNATIONALE
DE BRUXELLES 1958**

The model MH 5106 gas analyser is designed to continuously determine the percentage oxygen content of flue gases in boiler installations.

The operating principle of the gas analyser is based on the thermomagnetic convection of the gas under investigation which depends upon the magnetic properties of oxygen.

A compensating arrangement consisting of two bridges (measuring and comparison) is used as the measuring element in this analyser.

The compensating-bridge arrangement ensures high stability of the indications of the instrument.

The MH 5106 gas analyser comprises a flue-gas receiving cell, electronic recorder, electronic indicator for remote duplication of the indications, and auxiliary equipment for cleaning the gas mixture of mechanical and chemically corrosive impurities, and decreasing its humidity.

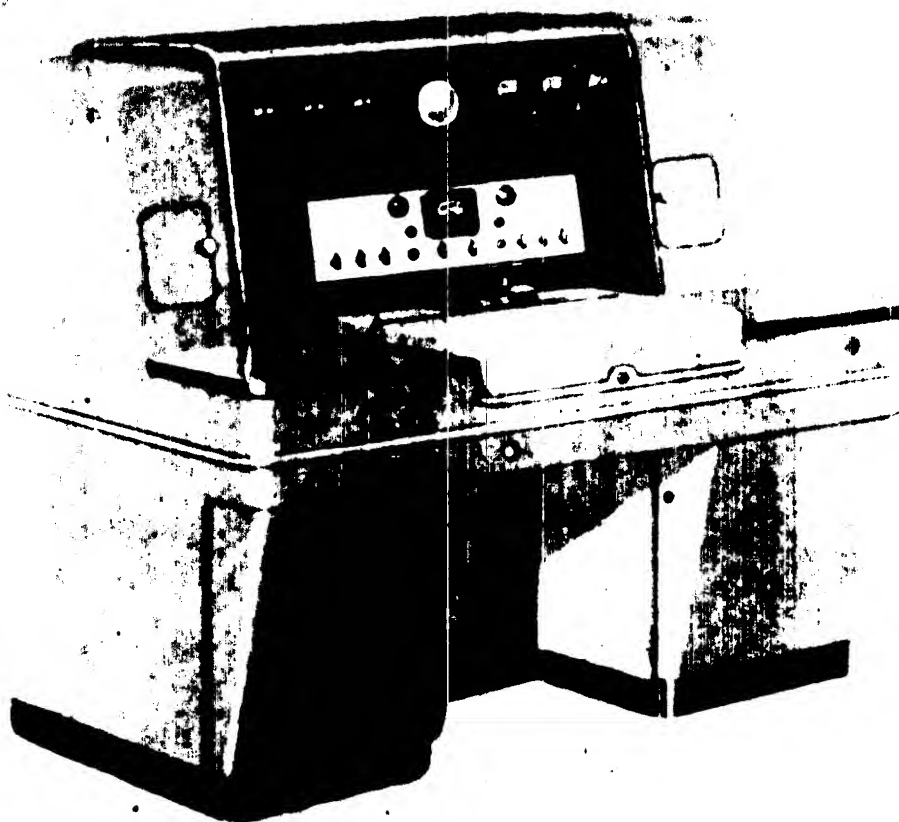
The complete set of auxiliary equipment includes a ceramic filter, cleaning unit, valve with a cross fitting, liquid pressure gauge unit with two control valves and flow indicators, water-jet pump and drain vessel.

The gas analyser is also furnished with a transformer and a voltage stabilizer.

The electronic recorder can be located at a distance of up to 300 m from flue gas receiving cell; the electronic indicator — up to 300 m from the recorder.

PRINCIPAL CHARACTERISTICS

| | |
|--|------------------------|
| Range of measurement of oxygen concentration | 0-10% (by volume) |
| Basic accuracy | ± 0.25% (by volume) |
| Reading lag time | not over 1.5 min |
| Supply voltage | 127 or 220 V at 50 c/s |
| Power consumption | 200 W |
| Overall dimensions of gas analyser, mm: | |
| Flue-gas receiving cell | 305 × 520 × 210 |
| Electronic recorder | 287 × 330 × 404 |
| Electronic indicator | 218 × 210 × 210 |
| Weight of gas analyser | 100 kg |



FLUOROMETRE DE PHASE

Fluoromètre est un appareil pour mesurer la durée de la luminescence dont l'extinction dure de 10^{-4} à 10^{-10} sec. Ces limites comprennent la période d'extinction de la luminescence d'une large classe des molécules organiques, des centres de luminescence dans les cristaux, de certains objets biologiques, etc.

L'appareil permet d'examiner les substances en état solide, liquide et gazeux.

Les blocs essentiels du fluoromètre peuvent être aussi employés pour mesurer les intervalles de temps s'écoulant entre deux signaux optiques qui ne sont pas liés à la luminescence.

La mesure de la durée de l'extinction de la luminescence au moyen d'un fluoromètre est fondée sur la détermination de déphasage de la modulation à haute fréquence de la lumière excitant la luminescence, par rapport à la phase de la modulation de la lumière lumineuse. La comparaison des phases s'effectue par l'introduction des décalages-étalons de phase dans un des canaux du phase-mètre et par la lecture sur l'appareil à aiguille.

Le pouvoir résolvant de l'appareil est de $2 \cdot 10^{-4}$ sec. La sensibilité à la lumière est telle qu'à l'aide de l'appareil on peut mesurer la durée de la luminescence 5-10 milles fois plus faible que l'intensité de luminescence de la fluorescéine.

L'appareil est alimenté du secteur à courant alternatif de 220 volts et du secteur à courant continu de 110 volts.

Encombrement - $1800 \times 700 \times 1300$ mm.

Poids - 500 kg.

Pour les commandes des appareils adressez-vous: «STANKO-
Mashin», Moscou, G-204, Smolenskaja-Sennaja ploshchad.

SECTION DE LUMINESCENCE OPTIQUES ET INTERNATIONALE DE BRUXELLES 1954

PHASE FLUOROMETER

The phase fluorometer is an instrument intended for the measurement of luminescence duration with an attenuation time ranging about 10^{-8} to 10^{-10} sec. These figures correspond to the limits of the attenuation time for a great variety of organic molecular centers of luminescence in crystals, some biological objects, etc.

The instrument may be applied for the investigation of solid, liquid and gaseous substances.

The main units of the fluorometer may be used for time interval measurements between two light signals of any nature.

Measurement of the luminescence attenuation time is based on the determination of the phase shift between the h.f. modulations of the luminescent and exciting radiations. Comparison of the phases is achieved by introducing some standard phase shifts into one of the phase meter channels and reading the needle indicator.

Resolving power is approximately 2×10^{-11} sec.

Luminous sensitivity is of such value that the apparatus may be used for measurements of radiation with a luminescence duration of 5 to 10 thousand times less than the minimum radiation intensity of fluorescein solution.

The instrument is operated from 220 V a.c. or 110 V d.c. mains.

Overall dimensions - $1500 \times 700 \times 1300$ mm.

Weight - 500 kg.

For delivery terms apply to "STANKOIMPORT", Moscow,
G-200, Smolenskaya-Sennaya ploshchad, 32/34.

PANK SECTION BRUSSELS UNIVERSAL AND INTERNATIONAL EXHIBITION 1958

PHASEN-FLUOROMETER

Das Phasen-Fluorometer ist ein Gerät für die Messung der Dauer einer Lumineszenz, die während der Zeit von ca. 10^{-8} bis 10^{-10} Sekunden abklingt. In diesem Bereich liegt die Abklingungsdauer der Lumineszenz einer weiten Klasse von organischen Molekülen, von Lumineszenz-Zentren in Kristallen, von einigen biologischen Objekten usw.

Das Gerät ermöglicht die Untersuchung von festen, flüssigen und gasförmigen Stoffen.

Die wichtigsten Teile des Fluorometers können für die Messung der Zeitintervalle zwischen zwei optischen Signalen beliebiger Herkunft verwendet werden.

Die Messung der Abklingungsdauer der Lumineszenz mit Hilfe des Fluorometers beruht auf der Bestimmung der Phasenverschiebung zwischen den Modulationen des Lichtes, die die Lumineszenz erregt, und des Lumineszenzlichtes. Der Vergleich der Phasen erfolgt durch die Einführung von Etalon-Phasenverschiebungen in einem der Phasometer-Kanäle und durch die Ablesung an einem Zeiger-Meßinstrument.

Das Auflösungsvermögen des Geräts nach der Zeit beträgt ca. $2 \cdot 10^{-11}$ Sekunden.

Die Lichtempfindlichkeit des Geräts ist so groß, daß man damit die Messungen der Dauer solcher Lumineszenz ausführen kann, die 5000-10 000 geringer ist, als die Lumineszenz-Intensität von Fluorescein.

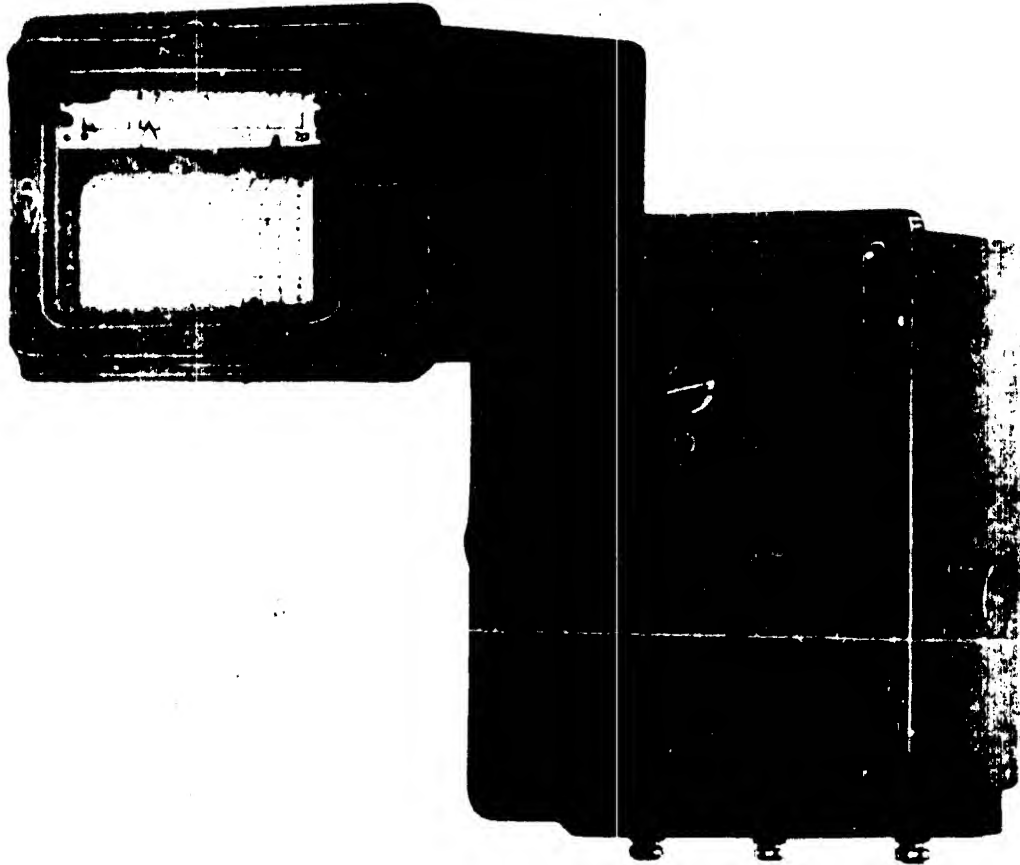
Die Stromversorgung des Geräts erfolgt aus einem Wechselstromnetz 220 V und aus einem Gleichstromnetz 110 V.

Abmessungen - $1500 \times 700 \times 1300$ mm. Gewicht - 500 kg.

Alle Lieferungsanfragen sind an "STANKOIMPORT",
Moskva, G-200, Smolenskaja-Sennaja Ploshchad, 32/34 zu richten.

ABTEILUNG DER UDSSR AUF DER ALLGEMEINEN Weltausstellung in BRÜSEL 1958

SECTION DE L'URSS A L'EXPOSITION UNIVERSELLE ET INTERNATIONALE DE BRUXELLES 1958



ANALYSEURS DE GAZ OPTICO-ELECTRONIQUES POUR OA 2109
MESURE AUTOMATIQUE DE LA Teneur EN OXYDE DE OA 2209
CARBONE, EN BIOXYDE DE CARBONE ET EN METHANE OA 2309

Les analyseurs de gaz optico-acoustiques, automatiques, à poste fixe, types OA 2109, OA 2209 et OA 2309, sont destinés à mesurer la teneur en oxyde de carbone (OA 2109), en bioxyde de carbone (OA 2209), ou en méthane (OA 2309), dans des mélanges gazeux contenant de l'oxyde de carbone, du bioxyde de carbone, du méthane, de l'azote, de l'oxygène et de l'hydrogène en quantités quelconques.

Ces appareils peuvent être utilisés pour le contrôle technologique dans les industries métallurgique, chimique, de verre, de ciment et de céramique ainsi qu'en biologie, médecine et dans d'autres domaines.

Le fonctionnement d'un analyseur de gaz optico-acoustique est basé sur la mesure de l'absorption par ce gaz du rayonnement infrarouge. Le taux d'absorption du rayonnement dépend de la concentration de la composante mesurée dans le mélange gazeux analysé.

Pour effectuer les mesures on utilise dans l'appareil un circuit optique différentiel.

Les analyseurs de gaz comprennent chacun un récepteur dans lequel on effectue la mesure du taux d'absorption du rayonnement infra-rouge par la composante mesurée du mélange analysé et un appareil électronique enregistreur étalonné pour le gaz à la mesure duquel est destiné l'analyseur considéré (CO , CO_2 ou CH_4).

Un stabilisateur de tension est également livré avec les analyseurs de gaz.

Les dispositifs auxiliaires (réfrigérants, filtres, etc.) destinés à l'élimination des impuretés mécaniques et chimiques corrosives du mélange gazeux analysé, à l'abaissement du taux d'humidité de ce mélange, sont livrés avec les analyseurs de gaz conformément aux conditions de leur exploitation.

PRINCIPALES CARACTERISTIQUES TECHNIQUES

| | |
|---|---|
| Plages de mesure de la concentration de l'oxyde de carbone, du bioxyde de carbone et du méthane | de 0 à 1, de 0 à 2, de 0 à 5, de 0 à 10, de 0 à 20, de 0 à 30, de 0 à 50, de 0 à 70, et de 0 à 100% en volume |
| Erreur propre de l'appareil | ± 5% de la limite supérieure de mesure |
| Délai des indications pour un débit de mélange gazeux analysé de 0,3 à 0,7 l/min | égal ou inférieur à 1 min |
| Tension d'alimentation | 127 ± 10 V, fréquence 50 ± 0,5 Hz |
| Puissance absorbée | 250 W |

The OA 2109, OA 2209 and OA 2309 type gas analysers are designed to measure the percentage carbon monoxide, carbon dioxide or methane (OA 2309) in gas mixtures containing carbon monoxide, carbon dioxide, methane, nitrogen, oxygen and hydrogen in any quantities.

The analysers can be used for technological control in the metallurgical, chemical, glass, cement and ceramic industries as well as in biology, medicine and other fields.

The operation of an optico-acoustic gas analyser is based on the measurement of the absorption of infrared radiation by the gas component being measured in the mixture.

A differential optical circuit is used to make the measurements.

The analysers each comprise a receiver in which the rate of absorption of infrared radiation by the gas mixture is measured and a calibrated electronic recording device for the gas to which the analyser is designed (CO , CO_2 or CH_4).

A voltage stabiliser is also supplied with the gas analysers.

Auxiliary equipment (refrigerants, filters, etc.) used to eliminate corrosive impurities from the gas mixture analysed, to reduce the humidity of the mixture, is supplied with the gas analysers in accordance with the conditions of their use.

Ranges of measurement of concentration by volume

Basic accuracy

Reading lag time at flow rate of 0.3-0.7 litres per minute

Supply voltage

Power consumption

Secondary optical-acoustic
continuously determine the
carbon dioxide (OA 2209)
mixture containing any
carbon dioxide, methane, oxygen,

process control in various
chemical, glass and
ceramic in biology, medicine
production.

acoustic type gas analyser
absorption absorbed by a
depends upon the concen-
tration of the gas

used as control element of

in which the degree
of particular component of
the gas mixture
of the gas mixture

stabilizer.

with rate boosters,
and chemically
are furnished to
with the conditions of

CHARACTERISTICS

0-5, 0-10,
0-20, 0-50, 0-70, 0-100%
5% of full range value

not over 1 minute

27 ± 10 V at 50 ± 0.5 c/s

Die ortsfesten selbsttätigen optisch-akustischen Gasanalysatoren
OA 2109, OA 2209 und OA 2309 dienen zum kontinuierlichen Messen
der Konzentration von Kohlenmonoxyd (OA 2109), Kohlendioxyd
(OA 2209) oder Methan (OA 2309) in Gasgemischen, die Kohlen-
monoxyd, Kohlendioxyd, Methan, Stickstoff, Sauerstoff und Wasser-
stoff in beliebigen Mengen enthalten.

Die Geräte können für technologische Prüfungen in der Hütten-
industrie, in der chemischen, Glas-, Zement- und keramischen Industrie
sowie in der Biologie, Meßkunde und auf vielen anderen Gebieten
benutzt werden.

Die Wirkungsweise der optisch-akustischen Gasanalysatoren be-
ruht auf der Messung der Absorption von Infrarotstrahlungen durch
das Gas. Der Strahlungsabsorptionsgrad hängt von der Konzentration
der Meßkomponente in dem zu analysierenden Gasgemisch ab.

Als Meßschema ist in den Geräten das optische Differentialschema
angewendet.

Die Gasanalysatoren bestehen aus einem Auffanggefäß, in
welchem die Messung des Absorptionsgrades der Infrarotstrahlung
durch die Meßkomponente des zu analysierenden Gasgemisches
ausgeführt wird, und einem elektronischen Schreibgerät, das für
dasjenige Gas geeicht ist, für dessen Messung der Gasanalysator
bestimmt ist (CO, CO₂ oder CH₄).

Zur Messung gehört auch ein Spannung-
versorgungsnetz (z. B. 220 V, 50 Hz), die
für die Messung des Gasgemisches von angreifender
Substanz sowie zur Herabsetzung
des Gasgemisches zusammen mit den Gasana-
lysatoren geliefert.

TECHNISCHE DATEN

0-1, 0-2, 0-5,
0-10, 0-20, 0-30,
0-50, 0-70, 0-100% volumengemisch
± 5% vom oberen Grenzmeßwert
höchstens 1 Min.
127 ± 10 V bei der Frequenz
50 ± 0,5 Hz
230 VA

**OPTICAL-ACOUSTIC TYPE GAS ANALYSER
FOR AUTOMATIC CO,
CO₂ AND CH₄ CONTENT DETERMINATION**

**OPTISCH-AKUSTISCHE GASANALYSATOREN ZUR
SELBSTTÄTIGEN BESTIMMUNG VON KOHLEN-
MONOOXYD, KOLENIOXYD UND METHAN**

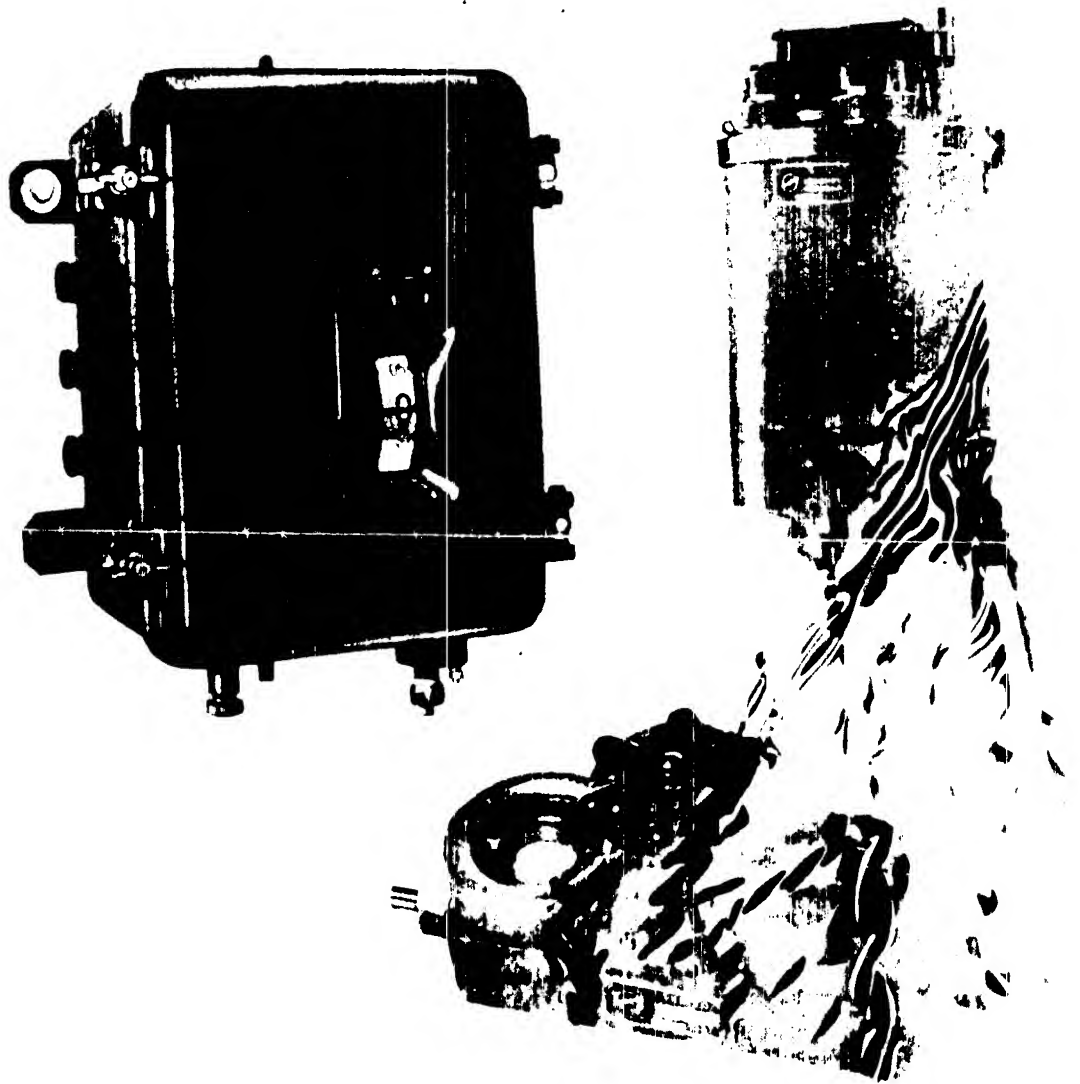
OA 2109

OA 2109

USSR SECTION, BRUSSELS UNIVERSAL AND INTERNATIONAL

ABTEILUNG DER UDSSR AUF DER ALLGEMEINEN Weltausstellung

**ANALYSEUR PHOTOCOLORIMETRIQUE
DE GAZ POUR LA MESURE AUTOMATIQUE
DE LA TENEUR EN BIOXYDE D'AZOTE**



**CONCEPTEUR DE L'URSS A L'EXPOSITION UNIVERSELLE ET INTERNATIONALE
DE BRUXELLES 1958**

The model $\Phi K 4501$ gas analyser is an automatic instrument designed to determine the NO_2 concentration of atmospheres in closed rooms with concentrations of within limits of 0 to 0.005 mg per litre. The analyser is equipped to signal approach of the NO_2 concentration to a definite, pre-set value.

The operating principle of the analyser is based on the photocolorimetric measurement of the light absorption of a solution which has preliminarily chemically reacted with the nitrogen dioxide contained by the sample of air passed through the working solution.

The light absorption of the solution depends upon the nitrogen dioxide concentration of the sample air and is determined with the aid of a photocolorimetric circuit by means of a null method with optical compensation of the photoelectric current.

The nitrogen dioxide concentration is measured periodically — every two minutes. The analyser will operate 200 hours without change of the solution.

Reaction of the air to be analysed with the solution and automatic measurement of the light absorption of the solution, with the sample air and equal volumes of the working solution periodically fed in the reaction cell, is effected in the receiving cell of the gas analyser.

The working solution is stored in the tank from which it is fed to the receiving cell by a gear pump.

The waste solution is returned to the tank and subjected to cleaning for removal of the coloured compound.

The complete set of the instrument also includes a regulating and filtering unit which is used for cleaning the sample air of mechanical impurities and for regulating the rate of flow through the receiving cell.

The auxiliary equipment, such as filter, pressure regulator, valves, etc., are furnished together with the analyser in accordance with the conditions of operation.

TECHNICAL SPECIFICATIONS

| | |
|---|---------------------------|
| Limits of NO_2 concentration measured | 0-0.005 mg per litre |
| Basic accuracy | 0.00005 mg per litre |
| Starting time of the analyser | 5-10 minutes |
| Reading lag time, not over | 5 minutes |
| Supply voltage | 127 V \pm 10% at 50 cps |
| Power consumption | 100 W |
| Overall dimensions, mm: | |
| Receiving cell | 485X344X170 |
| Tank | 338X196X167 |
| Regulating unit | 220X150X100 |

Der Gas-
Bestimmung
Raumluft
Signale
bestimmen

Die We-
metrische
den und
agierten
betroffend

Der
rige Licht-
schen Selbst-
Photostrom

Die
hische
wechselnd

Die Be-
und die
intermitt-
Volumen
gefällt den

Die A-
Auffange-
tete Faser-
Verbind-

Zum U-
dient, die
und die de-
ren und
Das
zusammen-
stehen ge-

Meßbereich
Grundmaße
Anlaufzeit
Vorgabe
Spezifikation
Leistungsa-
Außenmaße
Aufbau
Benutzung
Regelung

**PHOTOCOLORIMETRIC TYPE
GAS ANALYZER FOR AUTOMATIC
NO₂ - CONTENT DETERMINATION**

ΦK 4501

**PHOTOKOLORIMETRISCHER GASANALYSATOR
ZUR SELBSTTÄTIGEN
STICKSTOFFDIOXYDBESTIMMUNG**

ΦK 4501